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ABSTRACT

The National Science Foundation's Statewide Systemic Initiative (SSI) program attempted to address concerns about student performance in science, mathematics, and technology education. The SSIs were supposed to increase and improve student learning in these areas by having challenging academic standards, a hands-on approach to instruction, the use of curricula relevant to students' lives, emphasis on higher-order thinking skills, the use of technology in the classroom, and assessments that reinforce these instructional practices. Over the last 4.5 years, the New Jersey SSI (NJSSI) spent $15 million SSI dollars. This evaluation centered on three questions: (1) do students learn more because of the SSI; (2) are they better equipped to apply what they are learning to everyday problems; and (3) are the inequities in performance among different groups of students being reduced? The NJSSI had some reach in 446 schools (19% of the schools in New Jersey), a little implementation in 409 schools, and no reach at all in 1,402 schools. Evaluation data came primarily from state-mandated assessments. No evidence was found for the first evaluation question; students in NJSSI schools did not learn more than their counterparts in schools without NJSSI affiliation. Evidence with respect to the second question was too limited, and the question could not be answered. With regard to question 3, it was found that inequities in performance had actually worsened. The knowledge gap between underserved school districts and the rest of the state increased on the state-mandated eighth grade assessment in mathematics during the time the NJSSI was in operation. In addition, the knowledge gap between students from affluent suburbs and urban students increased in Advanced Placement Calculus, Advanced Placement Biology, and Advanced Placement Computer Science. (Contains five figures, eight tables, and nine endnotes.) (SLD)

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ED 424 292

Evaluating the Impact of Science, Math and Technology Initiatives on Student Achievement:

The Case of The New Jersey Statewide Systemic Initiative (NJSSI)

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Abstract

Launched 33 years after Sputnik, the National Science Foundation's (NSF) SSI program attempted to address concerns about student performance in science, math and technology education in the United States. The SSIs were supposed to increase and improve student learning of math, science and technology. The SSIs were going to accomplish this task by; having challenging academic standards, a hands-on approach to instruction, the use of curricula relevant to students' lives, emphasis on higher order thinking skills, the use of technology in the classroom, and assessments that reinforce the above mentioned instructional practices.

Over the last 4 1/2 years, the New Jersey Statewide Systemic Initiative (NJSSI) spent $15 million SSI dollars; attempting to improve science, math and technology education in New Jersey. Policy makers at the state and national level might like to know what impact NJSSI had, if any, on improving educational outcomes. Three evaluation questions highlighted our inquiry. (1) Are students learning more because of the SSI? (2) Are students better equipped to apply what they are leaning to everyday problems in the community and in the workplace? (3) Are the inequities in performance among different groups of students being reduced?

We found no evidence for the first evaluation question. Students in schools affiliated with NJSSI did not learn more than their counterparts enrolled in schools with no NJSSI affiliation. NJSSI did not add value to a school's educational achievement. The evidence with respect to evaluation question number 2 was too limited, and we could not answer it. With respect to evaluation question number 3, we found that inequities in performance got worse. The knowledge gap between the underserved school districts and the rest of the state increased on the state mandated 8th grade assessment in mathematics during the time NJSSI was in operation. Additionally, the knowledge gap between students from affluent suburbs and urban students increased in Advanced Placement Calculus, Advanced Placement Biology, and Advanced Placement Computer Science. In summary, the equity situation in New Jersey is worse today than when the SSI was birthed.

Introduction

The NSF SSI Program

Over the last eight years, the National Science Foundation (NSF) spent $265 million dollars attempting to improve math, science and technology education through its Statewide Systemic Initiatives (SSI) Program. Launched 33 years after Sputnik, the SSI program attempted to address concerns about student performance in science, math and technology education in the United States (CPRE 1995). Additionally, the SSI program was supposed to deal with equity issues associated with differential groups of student performance; race, ethnicity, and gender. NSF grants, awarded to states, were typically $10 million dollars over five years, with required matching funds from the state.

At its peak, 25 states and Puerto Rico participated in the SSI program. In 1996, the initial 10 states selected to participate in the program (called Cohort I) completed the five year grant. In 1997, an additional 10 states and Puerto Rico (called Cohort II) completed the five year grant. In 1998, the last five states (called Cohort III) completed their five year grant.

During the fifth year of a grant, states in each cohort could have competed against each other for a renewal grant from the NSF. Renewal grants could have requested funding up to $1.4 million dollars a year, but totaling no more than $6 million dollars over a five year period. In the first cohort, Connecticut and Louisiana were renewed. In the second cohort, Massachusetts, Puerto Rico, Texas and Vermont were renewed. The winners of the renewal competition for the third cohort were not known at the time this paper was written.

As the last cohort of states completes their five year grant, the NSF is downsizing the SSI program in two different ways simultaneously. The number of states participating the SSI program has been reduced. Additionally, the amount of award given to the states successful at winning renewal grants was reduced an average of 40%. At its peak in federal fiscal years 93 and 94, the NSF was spending $53-$54 million dollars on the SSI program. By federal fiscal year 97, it is anticipated that the NSF will spend $18 million dollars on the SSI program (1998 Program Effectiveness Reviews (PER) Report Statewide Systemic Initiatives [SSI] Program, 1998).

With the final states wrapping up their fifth year in the program, it is reasonable to ask whether the SSIs had the desired positive impacts on student performance in mathematics, science and technology. CPRE (1995) raises three evaluation questions pertinent to the SSIs

1. Are students learning more because of these SSIs?

2. Are students better equipped to apply what they are leaning to everyday problems in the community and in the workplace?

3. Are the inequities in performance among different groups of students being reduced?

We attempt to answer these evaluation questions in the context of a case study of one SSI, the New Jersey Statewide Systemic Initiative (NJSSI).

The SSIs were supposed to increase and improve student learning of math, science and technology by; having challenging academic standards, a hands-on approach to instruction, the use of curricula relevant to students' lives, emphasis on higher order thinking skills, use of technology in the classroom, and assessments that reinforce the above mentioned instructional practices.

As the name implies, the original intention of the Statewide Systemic Initiatives was systemic reform. At the start of the program (in 1990) the systemic reform fad was strong and gaining strength. Consistent with the systemic reform movement, the SSIs were supposed to form broad affiliations with a wide variety of different actors; school districts, institutions of higher education, informal education, and business and industry, to mention some of the most pertinent participants. Through these affiliates, the SSI was supposed to positively impact math, science and technology education holistically in a state. The NSF was were not looking for piecemeal change from the SSIs. The SSIs were supposed to facilitate a wholesale improvement of SMT education in a state. NSF expected that professional development of teachers would be a key component in each state's strategy for SMT educational improvement.

By 1995, the luster had come off the systemic reform fad. In the early years, proponents of systemic reform thought that low expectations from the educational system (teachers, principals and students) could explain less than satisfactory student performance. They reasoned that increasing expectations, and having high expectations for all students, would lead to increased student achievement. Evidence showed that the patterns of student achievement were unchanged in states that adopted the systemic reform model (Fenster, Stufflebeam, Wiersma, Nitko 1995). Additionally, despite many attempts to alter the educational system, the system itself did not change (Cohen 1995).

NSF responded to the challenges and limitations demonstrated at the end of the systemic reform period by embracing the standards-based curriculum reform initiative in the middle 1990's. The NSF did not change the name of the SSIs, but changed the focus of the work from systemic reform to standards-based curriculum. SSIs were expected to embrace the standards-based curriculum fad, and alter their professional development programs to include instruction in standards-base curriculum. Virtually all SSIs made this transition during the middle 1990's. By 1997, the SSIs were no longer considered systemic reform initiatives. The SSIs were seen as standards-based initiatives[1]. However, the shift to a standard-based initiative was not a 100% shift in focus. The SSIs were still working towards: a hands-on approach to instruction, the use of curricula relevant to students' lives, and an emphasis on higher order thinking skills. Additionally, assessment issues and equity concerns remained major foci for the SSIs.

The State of Education In New Jersey

The most urban state in the United States, New Jersey offers the educational researcher a blistering diversity of school districts within close proximity to each other. Education in New Jersey is characterized by a long record of local control, and a mosaic of many different school districts, which often have overlapping local jurisdictions subject to different of Boards of Education. Decentralization continues. In the last year alone, an additional 22 functional school districts were created. In the 1997-1998 academic year, New Jersey has 616 functional school districts. In many cases, school districts cover a limited number of grades; k-6, k-8, and 9-12, to mention

only a few combinations. Families that are residential stable during the time it takes a child to go from k-12 could end up sending that child to two or three different school districts.

Importantly, the extreme decentralization of school districts creates many homogenous school districts on racial and economic grounds. The recent "Quality Counts" study stated that New Jersey had some of the best (suburban) schools and some of the worst (urban) schools in the country (Education Week on the Web-Quality Counts '98: The Urban Challenge, 1998). School districts with considerable poverty exist in communities of affluence. Around Rutgers University, the City of New Brunswick is a "special needs" district, one of the poorest 28 communities in the state. All of the school districts surrounding New Brunswick are relatively upscale, wealthy suburban enclaves. Some of these communities (South Brunswick, North Brunswick, and Highland Park) are quite a bit upscale. The City of New Brunswick is a "pocket of poverty in an area of affluence". Such pockets of poverty are typical in New Jersey.

The New Jersey Department of Education

The New Jersey Department of Education (NJDOE) has some responsibility over every school district in the state. The NJDOE requires all 8th grade and 11th grade students to take state mandated assessments. In 1997, the NJDOE piloted a 4th grade assessment. The 4th grade assessment will be piloted a second time in 1998, before going "live" in 1999. By introducing a 4th grade assessment, the NJDOE will eventually bring nearly all of New Jersey's 2257 schools into the state's assessment program. In the not too distant future, nearly every school in the state will be subject to some level of public accounting with respect to the academic achievement of their students on state mandated assessments. Unfortunately, the elementary schools are currently not participating in the state's assessment program, and there is no public accounting of student performance in these 1281 schools.

New Jersey averages spending about $8300 per child for k-12 education, the highest per capita expenditure in the United States. However, that $8300 average figure varies by school district. In urban districts, far less is spent to educate each child. A 27 year legal battle, decided in 1997, found that the 28 so called "special needs" districts were not receiving a sufficient amount of state aid to educate their students. The court initially ordered that 26 out of the 28 "special need districts" receive an additional $246 million dollars[2]. This money was distributed to the 26 districts, starting in the 1997-98 academic year. The court has since ruled that an additional $312 million dollars needs to be distributed to give school children in these districts an appropriate education.

Three key points for the reader to understand the state of education in New Jersey: extreme decentralization, financial inequity, and racial and economic segregation of school districts. New Jersey is not different from many states in the northeast and midwest with respect to financial inequity and racial and economic segregation. However, due to the number of school districts, and the homogeneity of those school districts, New Jersey exhibits a far greater degree of economic segregation and financial inequity than most states.

The New Jersey Statewide Systemic Initiative

The New Jersey Statewide Systemic Initiative (NJSSI) was birthed in 1993, on the Busch Campus of Rutgers University, located in Piscataway (a relatively upscale suburban community) one mile north of the City of New Brunswick.

Faced with a mandate from the NSF to work with urban schools, but recognizing the dominant political ethos of New Jersey is suburban, the NJSSI launched two programs:

a professional development initiative, called Thrust I,
a systemic reform initiative, called Thrust II.

Much later, in response to a mandate from the NSF to scale-up, NJSSI launched a standards-based initiative, called Thrust III, in the summer/fall of 1997.

After spending nearly $15 million dollars ($10 million from NSF and a $5 million matching grant from the NJDOE), over the last 4 1/2 years, policy makers at the state and national level might like to know what impact the NJSSI had, if any, on improving SMT education in New Jersey. Motivated by the CPRE (1995) questions, we conducted an evaluation of the NJSSI to answer the question of impact.

Accomplishments of the NJSSI

Reach of NJSSI Professional Development at the School Level

At the school level, the SSI had some reach in 446 schools (19% of the total number of schools in the state), had a little reach in an additional 409 schools (18% of the total), and no reach in 1402 schools (62% of the total). Figure 1 presents this information in percentages.

Across the grade levels, NJSSI reached out to schools unevenly. NJSSI concentrated its professional development efforts at the lower grade levels (e.g., the elementary schools). At the junior high school level, NJSSI had trained at least one teacher in 281 out of New Jersey's 593 junior high schools, and had no reach in the other 312 schools. At the high school level, NJSSI had at least some reach in 35 out of New Jersey's 383 high schools, and had no reach in the other 348 high schools.

Student Reach

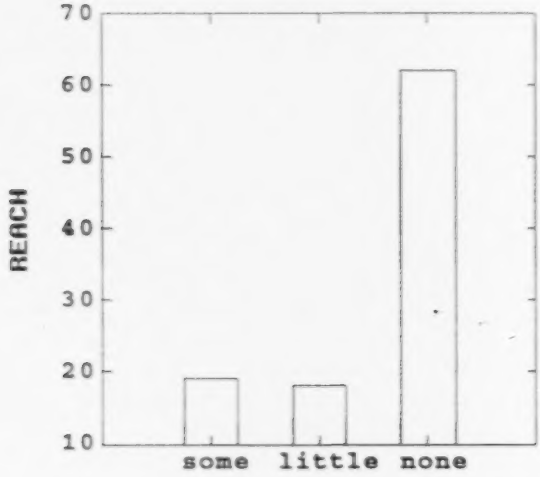
Estimating the number of students impact by NJSSI is not easy. For example, consider the high schools. There was no NJSSI activity in 348 high schools, enrolling 285,556 students. The students in these 348 high schools were not impacted by the SSI. However, what can we say about students enrolled in the 35 high schools where NJSSI was (at least) somewhat active? We know the SSI did not impact every student in these 35 schools. Arbitrarily, we assumed the SSI impacted 20% of the students in these schools. With that assumption, we concluded that NJSSI reached 2.2% of total number of high school students in New Jersey (7,328 out of 322,199).

Following the logic of the high school, we estimated the number of students reached by NJSSI in the middle schools. There was no SSI activity in 312 middle schools, with a total enrollment of 151,086 students. The remaining schools, with 184,253 students

had some SSI reach. Using the 20% rule, we estimated that the SSI reached 36,850 students, 11.0% of the 335,339 students enrolled in middle schools in the state of New Jersey.

Combining middle and high school students, we estimated that NJSSI impacted 6.7% of the 657,538 students enrolled in the middle and high school grades.

Figure 1: Percentage of Schools Reached by NJSSI

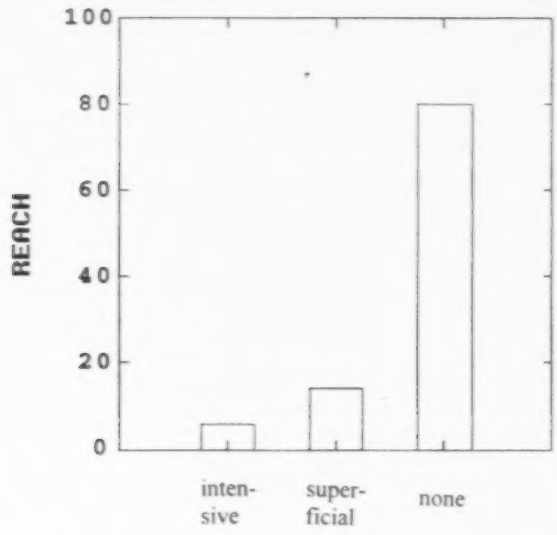


Teacher Reach

At the teacher level, the SSI reached 2600 science, math and technology (SMT) teachers intensively, through a "120 hour" professional development program. The SSI reached an additional 6000 SMT teachers superficially, generally through one day workshops. The 8600 teachers impacted in some way (intensive + superficial) represented 20% of the total SMT teachers in New Jersey. Figure 2 presents the percentages[3].

In summary, the SSI reached about 20% of the total SMT teachers in New Jersey and impacted 7% of the students in schools subject to New Jersey's state mandated assessment program.

Figure 2: Percentage of Teachers Reached by NJSSI



NJSSI's Impact on Student Achievement

Limitations of Using State Mandated Assessments to Impact of an Educational Reform Initiative.

There are a number of excellent reasons to avoid using state mandated assessments to determine the impact of an educational reform initiative impact. As Haertel (1994) noted, with any recurrent assessment, a tradition of past examinations develops, and over time, examiners become reluctant to make significant changes from year to year because teachers will not know what to teach. If that happens, the domain of assessment tasks will grow too narrow. Assessment scores will rise, but instruction will become stereotyped. As a consequence, students who have learned to do well on particular kinds of items included in the assessment may do poorly on equally valid items that are assessing the same skills in a slightly different way. With respect to the high stakes, 11th grade assessment that students are required to pass in order to graduate in New Jersey, Madaus (1988) noted that high stakes test scores may become the most important goal of education. Haertel (1994) pointed out an important component of education is lost when teachers and students work for higher scores on a high stakes assessment, instead of the intellectual attainments an increasing score is supposed to represent.

Stecher and Koretz (1996) highlight the corruptibility of repeated administrations of state mandated assessments. Scores on state mandated assessments tend to rise faster than other assessments, such as the National Assessment of Educational Progress (NAEP). The increasing scores on state mandated assessments gives comfort to state and local officials (governors, member of the state legislature, workers at the state board of education, school boards, superintendents, principals, leaders in business and industry, teachers, parents and students) that educational achievement is improving at the state and local level. People interested in educational policy at the federal level see very small increases in NAEP scores as evidence that educational achievement at the state and local level is not improving nearly as robustly as scores on state mandated assessments would suggest. The recent TIMSS report showing that 12th grade students in the United States scored below the international average in science and math, and exceeded the performance of only two nations would bolster this position (http://www.ed.gov/TIMSS/overview.html). The NSF is very much aware of these issues, and has invested time, effort and money to develop performance indicators in math and science that avoid using state mandated assessments (Stecher and Koretz, 1996).

A different criticism of using New Jersey's state mandated assessments to evaluate NJSSI's achievements comes from Leo Klagholz, State Education Commissioner in New Jersey. According to Klagholz, state tests are too easy! "There are districts that can't improve anymore." "Their scores have started to level off" (Chiles, 1998). Klagholz was referring to scores on the high stakes 11th grade assessment, where some schools are so close to a passing rate of 100%, they have no room to improve. Klagholz could also have been referring to some middle schools, who have over 95% of their 8th grade students in the top proficiency category.

However, there are some good reasons to use state mandated assessment scores to monitor the impact of an educational reform initiative. Schools care about the results of state mandated assessments. Results are printed in the newspaper, and schools can look good or bad to the outside community as a function of performance on an assessment. A favorite assessment of federal policy makers, NEAP, has no meaning to local school districts. No school district, school, or student receives a score on NEAP. Students, schools and school districts all receive scores on state mandated assessments. For this reason, state mandated assessments are far more meaningful for students, schools and districts than NEAP.

We understand the corruptibility of state mandated assessments. New Jersey's state mandated assessments have not been substantially changed in over 5 years. Despite the corruptibility problem, and the ceiling issue noted by the Commissioner of Education, we think that state mandated assessments provide ***one*** piece of evidence to assess the programmatic impact of an SSI. Thus, the strategy used in this paper follows most closely Upton and Supovitz's (1996) work in estimating the programmatic impact of Ohio's SSI.

System Level Effects: Knowledge Gap Increased on the Eighth Grade State Mandated Assessment in Mathematics

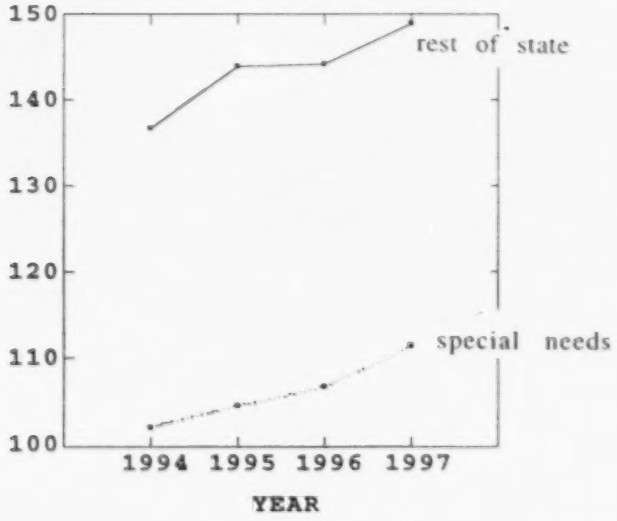
New Jersey assess nearly all 8th grade students, but only reports results on "regular" students. Students classified as special education (10% of all students) and limited English proficient (2% of all students) are not included in the New Jersey's reporting on state mandated assessments. The reporting function thus eliminates 12% of New

Jersey's school children. Therefore, analysis of New Jersey's 8th grade assessment is limited to 88% of the state's school children, so-called "regular" students.

The underserved districts compared to the rest of New Jersey

The underserved population of school children in New Jersey are heavily concentrated in so called "special needs districts"--the poorest 28 communities in New Jersey. These 28 school districts constitute less than 5% of the total number of school districts in the state. However, these districts tend to have large numbers of students, and serve over 21% of the school children in New Jersey. Newark, Jersey City and Paterson, the three largest school districts in the state, are classified as "special needs"[4].The vast majority of students in these districts come from families that have a lot of financial need. As an example, 85% of the children attending school in the Paterson district qualify for free or reduced lunch.

Figure 3: Increasing Knowledge Gap Between Special Needs Districts and the rest of the state of New Jersey in 8th grade mathematics, 1994-1997.



Mathematics. When NJSSI was birthed, the knowledge gap between the special need districts and the rest of the state on mathematics was measured at 34.4 points on the state mandated 8th grade assessment. Over the next four years, there was been a slight upward tend in the mean score on the mathematics section of the 8th grade assessment for these special needs students. In 1994, the mean score for students in special needs districts was

102.2, in 1995 104.6, in 1996 106.8., and in 1997 111.5. Over the same period, there has been a larger upward trend in the mean score on the mathematics section of the 8th grade assessment for students enrolled in all other districts. In 1994, the mean score for non-special needs districts was 136.6, in 1995 143.8, in 1996 144.3, and in 1997, 148.9. During the years the SSI has been in operation, the knowledge gap between the special needs districts and the rest of the state INCREASED by 3.0 points on the mathematics component of the state-mandated 8th grade assessment. The knowledge gap between the special needs districts and the rest of the state with respect to the mathematics 8th grade assessment is now 37.4 points. Figure 3 highlights the trend.

Reading. When NJSSI was birthed, the knowledge gap between the special needs districts and the rest of the state on reading was measured at 36.4 points on the state mandated assessment. Over the next four years, there was a upward tend in the mean score on the reading section of the 8th grade assessment. In 1994, the mean score for students in special needs districts was 113.6 in 1994, 116.7 in 1995, 120.0. in 1996, and 119.1 in 1997 Over the same period, there was a more gradual upward trend in the mean score on the reading section on the 8th grade assessment for students enrolled in all other districts. The mean score for non-special needs districts was: 150.0 in 1994; 151.3 in 1995; 152.2 in 1996; and 152.5 in 1997. During the years the SSI has been in operation, the knowledge gap between the special needs districts and the rest of the state DECREASED by 3.0 points on the reading component of the state-mandated 8th grade assessment. The knowledge gap between the special needs districts and the rest of the state on reading component of the 8th grade assessment is now 33.4 points.

Writing. When NJSSI was birthed, the knowledge gap between the special need districts and the rest of the state on writing was measured at 53.1 points on the state mandated assessment. Over the next four years, there was a downward tend in the mean score on the writing section of the 8th grade assessment. In 1994, the mean score for students in special needs districts was: 114.0 in 1994; 121.1 in 1995; 113.6 in 1996; and 109.9 in 1997. Over the same period, there was a similar downward trend in the mean score on the writing section on the 8th grade assessment for students enrolled in all other districts. The mean score for non-special needs districts was: 167.1 in 1994; 176.2 in 1995; 160.6 in 1996; and 163.9 in 1997. During the years the SSI has been in operation, the knowledge gap between the special needs districts and the rest of the state increased by less than 1 point on the writing component of the state-mandated 8th grade assessment.

Summary. In summary, during the time that NJSSI was in operation, the knowledge gap increased in mathematics, stayed about the same in writing (albeit with declining scores) and decreased in reading.

Importantly, NJSSI management knew about the increasing knowledge gap between the special needs districts and the rest of the state on the mathematics component of the 8th grade assessment. The knowledge gap was documented year after year in the summaries of the state mandated 8th grade assessment in mathematics (March 1996 Grade 8 Early Warning Test (EWT) State Summary, 1996; March 1997 Grade 8 Early Warning Test (EWT) State Summary, 1997). Despite seeing repeated documentation that the knowledge gap was increasing in mathematics, management of NJSSI ignored the problem.

Science

The New Jersey State Department of Education (NJDOE) does not currently assess science[5]. Science achievement will be assessed when the 4th grade assessment goes "live", in 1999. The NJDOE plans to add science to the 8th and 11th grade assessments in the near future. Overall, there is virtually no evidence concerning whether NJSSI is having an impact with respect to science achievement. Additionally there is no evidence whether the science impact is positive, neutral, or negative.

NAEP recently released state breakdowns on science. Unfortunately, the 1997 data did not include New Jersey. Horizon Research Inc., NJSSIs external evaluator, conducted a small exercise, using unvalidated, non-standards based science questions for 4th and 5th grade students. Results from these exercises revealed that students of teachers that underwent SSI involvement scored significantly better than teachers who had volunteered to undergo SSI training, but had not yet received such training in 1996 (23 classes, 489 students), and significantly worse in 1997 (27 classes 485 students)[6]. Realistically, nothing can be concluded from these exercises. Importantly, NJSSI's impact on science achievement is unknown.

Management Issues: Demand for NJSSI Services

Professional Development

NJSSI had limited and decreasing capacity to deliver intensive professional development to the state of New Jersey. By 1998, the capacity of the seven institutions of higher education (IHEs) still participating in the Thrust I (professional development program) was only 240 seats[7]. However, demand for these seats was far lower than supply. While the final numbers of participating teachers for 1998 are not yet in, the cohort started in the spring of 1998 with only 70 teachers across all seven professional development sites combined. In 1998, NJSSI's professional development program was running at 29% of capacity.

In the first four years, NJSSI paid full cost for teachers participating in the professional development program. Additionally, the NJSSI awarded participating teachers a "mini-grant" which enabled them to buy $500 worth of material for the classroom. Districts did not have to pay anything for training sponsored by NJSSI. As far as the districts were concerned, the NJSSI professional development program could be seen as a "free good"[8]. By paying full cost, the SSI allowed sites to get up and running quickly. However, some institutions of higher education become completely dependent on the SSI for the program, preventing the sustainability and institutionalization of the professional development initiative after federal and state funds run out. NJSSI tried to reduce its costs, and increase the sustainability and institutionalization of the program by making two management changes in the program between 1997 and 1998.

In 1998 NJSSI reduced the funding for each site by 50% (from $67,000 to $33,000), expecting that the lost revenue to the professional development sites would be partially made up by requiring teachers to pay $500 each to receive the training. The $500 fee could be paid by teachers, or, more likely, school districts. Additional money was saved by eliminating the mini-grants.

During focus groups held in the summer of 1997, 50% of the participants warned NJSSI that their district would not have paid them to attend the training, and without district payment, they would not have participated. Similarly, the professional development sites were concerned that the program could not be sold to districts. Management of NJSSI ignored this information, and never asked school districts their interest in picking up part of the costs to fund the program. To date, the strategy of cost sharing between participants involved in professional development and the SSI can be evaluated as quite a bit less than successful.

Across all seven sites, only 70 teachers have signed up to receive SSI training, about 0.2% of the targeted market of science, math and technology (SMT) teachers throughout the state of New Jersey. The districts are not coming forward with the $500 fee, and teachers are less interested in participating due to the lack of mini-grants. Combing 1997 and 1998, NJSSI will train around 300-400 teachers, less than 1% of the targeted market of 42,000 SMT teachers in New Jersey. With attrition and retirement of previously trained teachers, the market share of teachers that received NJSSI intensive professional development training in the state dropped in 1997, and will continue to drop through the end of 1998.

Cost Per Participant of NJSSI's Professional Development Initiative

Year	Cost to NJSSI	Number of Participants	Cost Per Participant
1997	$745,000	213	$3540
1998	$256,000	70*	$3657*

* Number of participants in 1998 subject to change. Cost estimates may change as well.

An Request for Proposal to scale-up

In response to a mandate from the NSF to "scale-up" and work with more than 31 districts in the state, NJSSI sent out a Request for Proposals (RFP) in early 1997 for implementation of standards-based curriculum and assessment (called Thrust III) to the (then) functioning 594 school districts in the state. Additionally, the RFP was sent to private and charter schools Sixty-two districts and four private schools responded to the RFP, requesting $645,700 of SSI money to engage in a professional development program based on standards-based curriculum. The SSI had allocated $750,000 for the program, so the total amount of money requested was below the amount allocated. The SSI was in a position to fund all proposals. Again, the supply of SSI services exceeded demand.

At time of this writing, seven districts dropped out of the Thrust III (standards implementation) initiative. Eliminating these districts brought the total amount of money spent on the program to $550,000, about 27% less thane amount allocated.

Statewide Services

The SSI had a small program to provide statewide services to the Thrust II (systemic reform) initiative. About $185,000 was allocated to the program, but the SSI received few requests to participate in the program. Less than $100,000 was requested

statewide. Again, demand for SSI services was very low, and the SSI could not award all of its money.

Summary: Demand for NJSSI Services

Overall, the demand for NJSSI services by school districts and teachers was below supply. The SSI has been unable to award all of its goods and services, and has received few requests for its 1998 professional development program. One solution to the problem of low demand would be a reduction in supply. If NJSSI is renewed by the NSF, the SSI's budget will likely be reduced by 30%. The reduction in budget will reduce supply, and should help correct the current imbalance between supply and demand. If demand remains constant, the decrease in supply of SSI's services after 1998 will bring this market into equilibrium.

Sources of Data-

The 1997 New Jersey School Report Card (an 8MB file) is on the Web, and can be accessed with any standard Internet browser (http://www.evalsoft.com/NJ). The NJ School Report Card has a wealth of information on all 2,257 schools in the state. For middle schools, information on the 8th grade state mandated assessment is included. For high schools, information on the 11th grade state mandated assessment, SAT scores, AP enrollments and passing rates on AP exams, and self-report information on the transition to early adult life are reported, to mention some of the more pertinent variables. Attendance (faculty and student) are also on the school report card.

State summaries of the 8th and 11th grade state mandated assessments provided a common base of tabular information that is used by NJDOE and state policy makers. Additionally, the state summaries provided information on the socio-economic status indicator used by the NJDOE for each school district in the state. The socio-economic status indicator was merged, at the school level, into the NJDOE school report card.

Finally, programmatic information on NJSSI, including school districts sill involved with various SSI programs, school districts that dropped out of the SSI program, as well as number of teachers involved with the NJSSI's professional development program was merged, at the school level, into the NJDOE school report card.

Data Analysis

State Mandated Assessments: 8th Grade

The NJDOE measures student performance on the 8th grade assessment using three proficiency levels: level I (the highest level, indicating students demonstrated clear competence in critical thinking skills measured by the assessment), level II (students demonstrated minimal competence based on the assessment), and level III (below the state minimum based on this performance). The low gain indicators track movement out of level III. The signs for the low gain indicator have been changed so that a positive score indicates a decreased percentage of students in level III and a negative score indicates an increased percentage of students in level III. We note here that the mathematics scores on the 8th grade assessment were the lowest of the three disciplines assessed. Scores on the writing assessment dropped, but 59% of the regular students in the state still scored at the highest level. Math scores increased modestly, but only 44% of the regular students in the state scored at the highest level.

The dependent variables represent percentage change scores. The percentage of students scoring a particular category in 1995 was subtracted from the percentage of students scoring in the same category in 1997. The change score calculated by this process had a theoretical range from -100 to +100. However, to score -100, a school needed to move from 100% of the students from a particular category in 1995 (say, Math Level III) to 0% of the students in the same category in 1997 (say, Math Level III). To score +100, a school needed to move from 0% of the students in a given category in 1995 (say, Math Level III) to 100% of the students in a given category in 1997 (say, Math Level III). No New Jersey schools showed anything close to these movements. Table 1 shows the mean change score for each component of the 8th grade assessment.

A math low gain of 4.31 meant, on average, that 4.31% fewer students in a school scored at Level III, the lowest proficiency. A math high gain of 4.86 meant that an additional 4.86% of the students in a school scored at Level I, the highest proficiency. A negative score associated with a high gain meant that fewer students scored level I in 1997 than scored level I in 1995. A negative score associated with low gain meant that a greater number of students scored level III in 1997 than scored level III in 1995. Table 1 presents a summary of the six change scores.

Table 1: Changes in 8th Grade State Mandated Assessment Scores, 1995-1997

Subject	Increase (+) or Decrease (-) in Score
Math Low Gain	4.31
Math High Gain	4.86
Reading Low Gain	0.98
Reading High Gain	-1.49
Writing Low Gain	-4.865
Writing High Gain	-8.922

Table 2a: Regression Models Predicting to Increasing Scores on 8th Mathematics Component of the State Mandated Assessment

	Dependent Variables	
Independent Variables	Math Low Gain	Math High Gain
Constant	7.9***	5.735***
Thrust I	-2.306	-1.01
Thrust II	0.993	-3.14
Socio-economic Status	-1.19***	-.003
R2	.079	.008
N	446	446

Table 2b: Regression Models Predicting to Increasing Scores on 8th Reading and Writing Component of the State Mandated Assessment

	Dependent Variables			
Independent Variables	Reading Low Gain	Reading High Gain	Writing Low Gain	Writing High Gain
Constant	2.357*	.761	-8.105***	-10.142
Thrust I	.633	.049	-.043	1.743
Thrust II	.005	-.333	-.004	1.415
Socio-economic Status	-.385	358	425	425
R2	.018	.002	.050***	.001
N	358	358	425	425

Entries in the regression tables associated with the independent variables are unstandardized beta coefficients.

* means p<.05
** means p<.01
*** means p<.001

None of NJSSI's programs had a significant impact in improving educational performance in the state mandated assessments on mathematics, reading or writing. As shown in Tables 2a and 2b, not only were all 12 coefficients representing NJSSI's programmatic impact statistically insignificant, but six of them (50%) had the wrong sign! NJSSI's programs were as likely to have a negative impact on student achievement as a positive impact. Mathematics had the greatest number of negative coefficients. In mathematics, NJSSI's Thrust I (professional development) program had a NEGATIVE impact in improving educational performance in both the low and high gain indicators. NJSSI's Thrust II (systemic reform) program had a very small, statistically insignificant, positive coefficient on the low gain indicator, and a bigger, statistically insignificant NEGATIVE coefficient on the high gain indicator. The negative coefficients show that non-SSI schools made larger positive gains in student achievement than the SSI schools.

Caveat: Extent of NJSSI's Reach

We have discussed NJSSI's reach as if such reach is a dichotomy; it happened, or did not happen. In reality, NJSSI reached schools very unevenly. In most cases, NJSSI had no reach into a school. In middle schools, NJSSI had some reach in 276 (46%) of 593 schools. However, in 122 of those 276 schools (44%), the SSI's reach was limited to professional development experiences with 1-2 teachers. Such superficial reach may not be sufficient to positively alter a school's educational achievement or instructional program. A couple of teachers may be below the threshold necessary to create a critical mass of "change agents" (Berman and McLaughlin, 1974) required to effect educational change.

The NSF understood this point, and required all SSIs to report the number of "focal schools". The focal schools, as understood by this author, was an attempt by the NSF to require SSIs to count schools they had reached at a depth greater than superficial.

We analyzed our data to account for levels of reach. We found no difference in student achievement when comparing Tables 2a and 2b to NJSSI's focal schools. However, we did find a greater impact in achievement when limiting our analysis to schools that had at least 7 teachers undergo NJSSI training. The student achievement effect was small, and the number of middle schools with 7 or more teachers trained by NJSSI limited (75 schools, or 12.6% of the total). However, the achievement effect was discernible.

These results highlight a fundamental tension in SSI programs; depth vs. breadth of reach. Early in the program, the NSF wanted SSIs to focus on depth. Working intensively with a limited number of schools, the SSI would implement an educational reform initiative that eventually would positively impact a school. The change model would then be scaled-up in a number of ways: the SSI could branch out and work with other schools, or schools not involved in the program would see gains made by those involved in the program, and make changes to mirror the other school's success. However, as the SSI program evolved, breath became more important than depth. The new strategy was to work with as many schools as possible, even if it meant that each school was only getting a very small benefit from affiliating with an SSI.

In response to different NSF mandates over the years, NJSSI changed gears and focused on breath over depth. As a result, NJSSI spread itself too thin, and had superficial reach in 201 out of 276 middle schools (73%) where the SSI was at least minimally active. NJSSI did not positively impact student achievement in these schools. We note here the NSF's classification of focal schools was insufficient to impact student achievement. Five teachers, or 25% of a school's SMT teachers were not enough to effect educational change. Training of seven (or more) teachers was needed before a school began to show positive growth curves in student achievement, over and above what was expected by chance and socio-economic characteristics of students.

NJSSI Impacts at the High School Level

Enrollment in Advanced Placement Courses and Passing Rates on Advanced Placement Exams: Calculus

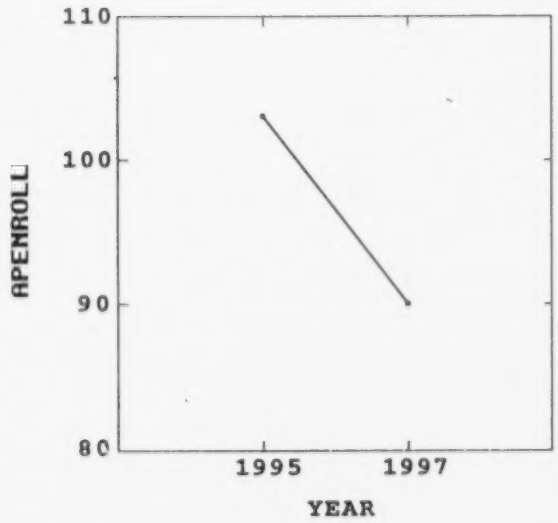
Table 3 presents the analysis of Advanced Placement enrollments and passing rates on Advanced Placement exams in the state of New Jersey. Between 1995 and 1997, enrollments in AP calculus increased 8.3%, from 4,954 students to 5368 students, statewide. However, the passing rate on the AP exam dropped from 69% to 67%. The passing rate dropped across the entire socio-economic spectrum. The sharpest drop was observed in the urban districts (6%), and the smallest drop was observed in working class districts (1%).

Urban schools affiliated with the SSI experienced decline in number of students taking the AP Calculus course (see figure 4) and a 7% decline in the passing rate (20% in 1995, 13% in 1997). Urban schools with no SSI affiliation experienced an increase in enrollment, and a 6% decline in the passing rate on the AP calculus exam (29% in 1995, 23% in 1997).

Table 3: Advanced Placement Enrollments, and Passing Rates on AP exams, State of New Jersey, 1995-1997

Subjects	Enrollment 1995	Enrollment 1997	Passing Rate on AP Exam 1995	Passing Rate on AP Exam 1997
Calculus	4954	5368	69%	67%
Biology	3192	4181	69	75
Chemistry	1696	2214	67	65
Physics	1123	1686	65	56
Computer Science	282	694	50	46
English Literature	4960	5859	73	73
English Language	1102	1668	63	73
All Others Combined	9208	12456	63	73
Total of all AP Courses Combined, Entire State	26517	34126	68	68

Figure 4: Declining enrollment of AP Calculus courses in NJSSI Affiliated Urban Schools 1995-1997



Enrollment in Advanced Placement Courses and Passing Rates on Advanced Placement Exams Biology

Between 1995 and 1997, enrollments in AP biology increased 31.0%, from 3,192 students to 4,181 students, statewide. The passing rate on the AP exam increased from 69% to 75%. The passing rate increased across most of the socio-economic spectrum. The sharpest increase was observed in the most affluent suburban districts (9%). Students in urban schools increased their passing rate on the exam by 4%.

Urban schools affiliated with the SSI experienced a 29% decline in number of students taking the AP Biology course, and a 3% ***decline*** in the passing rate (22% in 1995, 19% in 1997). Urban schools with no SSI affiliation experienced a 22% increase in enrollment, and a 6% increase in the passing rate in AP Biology (23% in 1995, 29% in 1997).

Enrollment in Advanced Placement Courses and Passing Rates on Advanced Placement Exams Chemistry

Between 1995 and 1997, enrollments in AP chemistry increased 30.5%, from 1,696 students to 2,214 students, statewide. The passing rate on the AP exam dropped from 67% to 65%. The change in passing rate fluctuated across the socio-economic spectrum. The sharpest drop was observed in the most affluent suburban districts (8%). The passing rate for students in urban schools was unchanged between 1995 and 1997 (27% in both years). Less affluent suburban districts experienced modest increases in the passing rates.

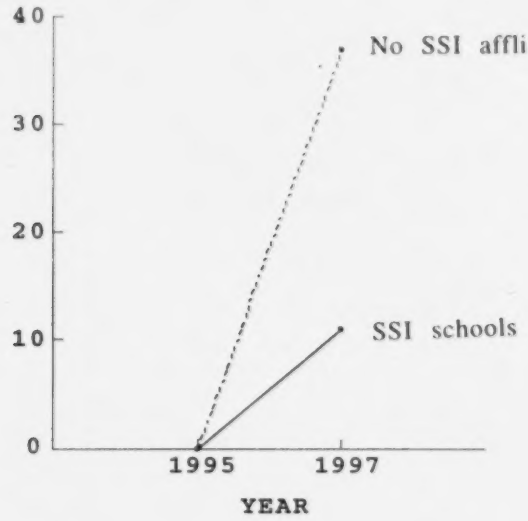
Urban schools affiliated with the SSI showed a very small enrollment drop in AP Chemistry during 1995-1997, and a 1% increase in the passing rate on the exam (7% in 1995, 8% in 1997). Urban schools with no SSI affiliation experienced a small gain in enrollment, and a 1% decrease in the passing rate (37% in 1995, 36% in 1997).

Enrollment in Advanced Placement Courses and Passing Rates on Advanced Placement Exams Physics

Between 1995 and 1997, enrollments in AP Physics increased 50.1%, from 1,123 students to 1,686 students, statewide. The passing rate on the AP exam dropped from 65% to 56%. The passing rate increased most sharply among students in urban schools. In 1995, not one student from an urban school passed the AP Physics exam in the entire state of New Jersey! In 1997, 26% of students in urban schools passed the AP Physics exam. Decreases in the passing rate of 8% were observed in the working class and less affluent suburban areas.

Urban schools affiliated with the SSI experienced a 200% increase in the number of students taking the AP Physics course, and an 11% increase in the passing rate (0% in 1995, 11% in 1997). Urban schools with no SSI affiliation experienced a 733% increase in enrollment, and a 37% increase in the passing rate (0% in 1995, 37% in 1997). Figure 5 presents the trend lines. However, one should keep in mind that the analysis of AP physics enrollment, and passing rates on physics AP exams are based on small numbers. When looking for socio-economic differences these numbers become even smaller. The percentage increase in enrollments are impressive, but based on a slender empirical base.

Figure 5: Increasing Percentage of Urban Students Passing the Advanced Placement Physics Exam, 1995-1997



Enrollment in Advanced Placement Courses and Passing Rates on Advanced Placement Exams Computer Science

Between 1995 and 1997, enrollments in AP Computer Science increased 146.1%, from 282 students to 694 students, statewide. The passing rate on the AP exam decreased from 50% to 46%. The sharpest drop in the passing rate on the Computer Science exam, 14%, was observed in the urban schools (25% in 1995, 11% in 1997). The sharpest increase in the passing rate on the Computer Science exam, 4% was observed in the affluent suburban schools (58% in 1995, 62% in 1997).

However, one should keep in mind that the analysis of computer science AP enrollment, and passing rates on computer science AP exams were based on very small numbers. There was an insufficient number of urban students taking the AP Computer Science course and exam, precluding a comparison of SSI affiliated, and non-SSI schools.

Enrollment in Advanced Placement Courses and Passing Rates on Advanced Placement Exams English Literature

For comparison purposes, we include a discussion of AP enrollments of English Literature, the most popular AP course in New Jersey, and an analysis of all other AP courses combined. This comparison will enable the reader to assess AP enrollments and passing rates for subjects other than science, math or technology.

Between 1995 and 1997, enrollments in AP English Literature increased 18.1%, from 4,960 students to 5,859 students, statewide. The passing rate on the AP exam remained stable at 73%. There was some fluctuation in the change in passing rate across the socio-economic spectrum. A drop of 3% was observed in the most affluent suburban schools (90% in 1995, 87% in 1997). The passing rate for students in urban schools was essentially unchanged between 1995 and 1997.

Urban schools affiliated with the SSI showed an increase of 15.8% in AP English Literature enrollment, and a 1% drop in the passing rate on the exam (24% in 1995, 23% in 1997). Urban schools with no SSI affiliation experienced a larger gain in enrollment (48.9%), with the same 1% decrease in the passing rate on the exam.

Enrollment in Advánced Placement Courses and Passing Rates on Advanced Placement Exams All other AP courses combined

Between 1995 and 1997, enrollments in all other AP courses increased 35.3%, from 9,208 students to 12,456 students, statewide. The passing rate on the AP exam remained stable, at 66%. The change in passing rates for all other AP courses combined fluctuated narrowly across the socio-economic spectrum, with no major differences in any particular group.

Urban schools affiliated with the SSI showed an 63.1% increase in enrollment for all other AP courses combined, and a 16% increase in the passing rate on all of the other AP exams combined (27% in 1995, 43% in 1997). Urban schools with no SSI affiliation experienced a 98.0% increase in enrollment, and a 6% drop in the passing rates on all of the other AP exams combined (42% in 1995, 36% in 1997).

Table 4: Summary: Comparison of Performance Gains between Urban Schools Affiliated with NJSSI, and Urban Schools with no NJSSI Affiliation in Science, Mathematics and Technology (SMT) AP courses, 1995-1997

Subject	Schools Affiliated with NJSSI	Schools with no NJSSI Affiliation	No Difference
Calculus		Advantage	
Biology		Advantage	
Chemistry			Very Close
Physics		Advantage	
Computer Science			Numbers too small for analysis
TOTAL	0	3	2

As summarized in Table 4, urban schools with no SSI affiliation showed greater gains in AP enrollments and sharper increases in passing rates on SMT AP exams than urban schools affiliated with NJSSI. In no case, did the urban schools affiliated with the SSI outperform urban schools without NJSSI affiliation.

Table 5: Equity Issues in passing rates on AP exams.

Subject	Knowledge Gap in 1995	Knowledge Gap in 1997	Change in Knowledge Gap, 1995-1997
Calculus	59%	63%	Increased by 4%
Biology	59%	64%	Increased by 5%
Computer Science	33%	51%	Increased by 18%
Physics	79%	56%	Decreased by 23%
Chemistry	58%	50%	Decreased by 8%

Equity

We computed a knowledge gap by comparing the passing rate on AP exams from schools in the most affluent suburbs with the urban schools. In all cases, the affluent suburbs had substantially higher passing rates than urban schools. We wanted to assess whether the knowledge gap increased, decreased, or stayed the same during the time NJSSI was in operation.

The results of this analysis are shown in Table 5. In 1995, the knowledge gap was considerable in all subject matters, ranging from a low of 33% in Computer Science, to 79% in Physics. In 1997, the knowledge gap was at least 50% in all subjects. We note here that the knowledge gap increased in 3 out of the five subjects; Calculus, Biology and Computer Science. The knowledge gap decreased in 2 out of 5 subjects; Chemistry and Physics. Lastly, we soberly acknowledge the low passing rates of students in urban schools in all SMT Advanced Placement exams.

Student Performance on the High-Stakes 11th Grade State Mandated Assessment

Table 6: Passing Rates on the High-Stakes, 11th Grade State Mandated Assessment, 1994-1996

Year	Math	Reading	Writing	All Sections Combined
1994	84.4%	83.2%	88.5%	73.2%
1995	86.2	83.4	90.4	75.6
1996	85.9	83.4	90.5	74.8
Change in Passing Rates, 1994-1996	1.5%	0.2%	2.0%	1.6%

Note: The 11th grade assessment is given in October and again in April. The October 1997 and April 1998 results from this assessment will not be available until December 1998 (or later).

The 11th grade state mandated assessment in New Jersey is a high stakes test for students--students have to pass the assessment to graduate. As reported in Table 6, nearly 3/4 of students pass all components of the assessment. Writing has the highest passing rate, reading the lowest. The passing rate of the mathematics component of the assessment dropped by a very small amount, 0.3% in 1997. It was the first time that the passing rate in mathematics dropped since the assessment was moved to the 11th grade.

Klagholz noted (see Chiles, 1998) and we recognize, that the analysis of passing rates of the 11th grade assessment suffer from ceiling effects. Passing rates on the assessments, especially from schools in affluent suburban communities, exceed 95%. Schools in affluent suburban communities have little room for additional improvement. However, schools in special needs districts have plenty of room for improvement. Passing rates for the mathematics and reading sections are between 55% and 60% for schools in special needs districts. The passing rate on the writing section is 74.0% in the special needs districts.

Table 7: Regression Analysis of Changing Passing Rates on the High-Stakes, 11th Grade State Mandated Assessment, 1994-1996

	Component		
Independent Variables:	Math	Reading	Writing
Constant	.587	-3.750	-.783
Thrust II	1.845*	.515	.685
Socio-economic Status	.001	.591***	.130
Mobility	.000	.002	.135***
N	299	299	299
R2	.013	.062***	.084***

Entries in the regression tables associated with the independent variables are unstandardized beta coefficients.

* means p<.05
** means p<.01
*** means p<.001

With respect to mathematics, Table 7 shows that schools affiliated with the NJSSI had a 1.845% increase in the passing rate on the state mandated assessment, controlling for socio-economic status of a school and mobility. The 1.845% increase was (just barely) statistically significant. Neither mobility, nor socio-economic status explained changing passing rates on the math component of the 11th grade state mandated assessment. An R^2 of .013 indicates the model has virtually no explanatory ability to predict changing passing rates on the mathematics 11th grade state mandated assessment, and the entire equation is statistically insignificant.

With respect to reading, Table 7 shows that schools affiliated with the NJSSI had a 0.515% increase in the passing rate on the state mandated assessment, controlling for socio-economic status of a school and mobility. The 0.515% increase was statistically insignificant. Mobility had no explanatory power to explain changing passing rates on the state mandated assessment. Socio-economic status did have a significant impact on changing passing rates. Every step up the socio-economic ladder resulted in a 0.591% increase in students passing the reading assessment, controlling for mobility and the SSI program. An R^2 of .062 indicates the model has virtually no explanatory ability to predict changing passing rates on the reading 11th grade state mandated assessment, even though the equation, taken as a whole, is statistically significant.

With respect to writing, Table 7 shows that schools affiliated with the NJSSI had a 0.685% increase in the passing rate on the state mandated assessment, controlling for socio-economic status of a school and mobility. The 0.685% increase was statistically insignificant. Socio-economic location of a school had no explanatory power to explain changing passing rates on the state mandated assessment. Mobility did have a impact on changing passing rates, but in the opposite direction to what was hypothesized. Higher rates of student mobility were associated with an increased passing percentage. An R^2 of .084 indicates the model has virtually no ability to predict changing passing rates on the reading 11th grade state mandated assessment, even though the equation, taken as a whole, is statistically significant.

In summary, we see a very small, positive, but discernible and (just barely) statistically significant effect for NJSSI's Thrust II program in increasing passing rates on the 11th grade state mandated assessment in mathematics. We see some very small, and statistically insignificant effects for NJSSI's Thrust II program in reading and writing. We note here that the coefficients representing NJSSI's programmatic impact in predicting increased passing rates in reading and writing were positive. These positive coefficients could be interpreted as very small spillover effects from the more narrowly focus disciplines the SSI tried to impact positively--math and science. Lastly, it could be argued that we are estimating population values (the NJDOE includes information on all 383 high schools in the state) and statistical tests, and statistical inference have no meaning for this data set.

Scholastic Aptitude Test Results

The mean score in New Jersey for the mathematics component was of the SAT exam was unchanged between 1995-1997. In 1995, the mean score was 511. The mean score dropped 3 points in 1996, and increased 3 points in 1997. The percentage of high school seniors taking the SAT in New Jersey was: 73% in 1995, 75% in 1996 and 74% in 1997. With respect to math, we see a 1% increase in the percentage taking the SAT, and no change in mean score.

Models predicting to changing SAT scores were estimated. The outcome of those models were similar to the 11th grade state mandated assessment. The SSI's program was unrelated to changing SAT scores in every model. No spillover effects were detected--with respect to the verbal component of the SAT, we found that schools affiliated with NJSSI had consistently lower gains on the verbal SAT, but those effects were small, and statistically insignificant. All estimated coefficients were statistically insignificant.

Transition to Early Adult Life

From the launch of Sputnik to the present day, there has been the argument that the United States needs to be first in the world in achievement in math, science and technology. It has been postulated that *if* the U.S. was not first in the world in SMT achievement, that the economic vitality of the country would somehow be put at risk. The argument follows the following lines. We all have a vested interest in improving SMT education. Failure to improve SMT education risks a downturn in our standard of living sometime in the next millennium. An evaluation of these statements are beyond the scope of this paper, but it is important to note that programs to improve SMT education continually get strong support from the U.S. Congress, the business community, and the general public due to these arguments.

Impact in state mandated assessments, advanced placement classes, advanced placement exams, and SAT scores are all specific and narrowly focused academic indicators to assess the impact of an SSI's short term instructional program. Longer term, SSIs would like to claim that its benefits are broader than particular courses taken, or assessments passed. SSIs would like to think that their benefits "stick to" students throughout their life cycle. Ideally, SSIs hope to facilitate improved life cycle outcomes for school children, and high school graduates though a better/easier transition to adult life (school to work, and secondary to post-secondary, to mention the two most common transitions to early adult life). From this broader perspective, state mandated test scores, AP exams, and SAT scores are but three indicators in the overall picture of student achievement. Additionally important indicators of the effectiveness of an SSI would be workplace readiness, graduation rates, percentage of students going on to college, and percentage of students with well defined career goals, to mention only a few examples from a very long list.

Thanks to the work of the NJDOE, we can look at career goals through a limited measure of transition to early adult life. The NJDOE collects self-report data on high school graduates as they prepare to enter adult life. We frankly acknowledge the limitations of using self-report data, especially when prospective high school graduates may be likely to report that they will be going on to college (2 or 4 year) when post-secondary education is not currently in their plans. Despite this limitation, a focus on transition to early adult life allows analysts to look for programmatic effects of an SSI that are far broader than immediate school achievement.

Table 8: Regression Analysis Predicting to Successful Transition to Early Adult Life

Independent Variables	b	Std. Error	Significance
Constant	81.607	1.458	p<.001
Socio-Economic Status	2.104	0.263	p<.001
Mobility	-0.080	0.030	p<.01
Thrust II	-1.662	1.820	Not Significant

R^2=.281
N=290

Table 8 presents estimates from a regression equation predicting to successful transition to early adult life. Most students anticipate a successful transition to early adult life (moving from secondary school to post-secondary [2 or 4 year], or moving from secondary school to work). Factoring out the effects of socio-economic status, mobility and the NJSSI's Thrust II program, we predict the percentage of students in a school anticipating successful transition to adult life to be 81.6%. Each move up the socio-economic scale increases the percentage of students anticipating a successful transition to adult life by 2.1%. In affluent suburban schools (four moves up the socio-economic scale from urban), we predict 90% of the students anticipate a successful transition to early adult life. Mobility negatively impacts transition to early adult life. A 1% percentage increase in mobility decreases the estimated percentage of students anticipating successful transition to early adult life by .08. Finally, the results show that the NJSSI had no significant impact on transition to early adult life. High schools involved in NJSSI's Thrust II program were predicted to have 1.6% fewer students anticipating successful transition to early adult life than schools with no SSI affiliation.

We find no evidence that NJSSI successfully impacted the transition to early adult life. However, we recommend that analysts looking for programmatic impact of reform initiatives like SSIs continue to look for and investigate broad dimensions of possible effects. Exclusively focusing on limited, and more immediate outcomes (in an SSI's case, performance on state mandated assessments, AP exams, AP passing rates, SAT scores, attendance, etc., does not capture some components of what an SSI was trying to accomplish.) The longer term impacts; workplace readiness, employability in the work force, confidence in new situation, if they can be shown to exist, would give reform initiatives far greater legitimacy than a demonstration of gains on a state-mandated assessment.

Conclusions

Conclusions Pertinent to NJSSI

(1) NJSSI never came to an understanding on how to deliver intensive professional development to New Jersey's teachers. The SSI's 1994-1997 strategy--pay for everything and hope for the best was, at the same time E & L (expensive and limited). Paying $3500 per teacher for professional development drained the NJSSI budget quickly, and helped limit the reach of the initiative. The 1998 strategy--have school districts pick up some of the costs--did not work due to poor relations between the NJSSI and school districts.

(2) Nobody employed at NJSSI had any subject matter expertise in urban education. Additionally, 88% of the people employed at the SSI lived in upscale, relatively wealthy suburban areas. Only one employee, and a relatively low ranking one at that, lived in one of special needs districts. From professional training, nobody employed in the NJSSI was qualified to deal with urban education. From personal experience, nobody employed at the SSI in a decision or policy making capacity had an understanding of the cultural, racial and economic factors that exert influence on special needs districts. These personnel issues may explain why NJSSI was not able to deal with the increasing knowledge gap found between the special needs districts and the rest of the state on the mathematics component of the 8th grade state mandated assessment.

(3) The NJSSI attempt to positively impact 8th grade mathematics achievement was unsuccessful. Not only were all 12 estimated coefficients for SSI programmatic activity statistically insignificant, but 50% of them had the wrong sign! The statistical effects of the program were worse than what would be expected by chance in mathematics, and better than chance for writing. Overall, the statistical effect was equal to chance.

NJSSI did had a small positive impact in improving 8th grade mathematics in schools where 7 or more teachers underwent the initiative's professional development experience. Where a critical mass of trained teachers existed, a small positive impact for student achievement was detected. For NJSSI, the finding had no practical value. The cost of seven teachers undergoing the initiative's professional development experience was $24,500 per school, and there are 2,257 schools in the state. The total cost to scale-up training in this manner, $55 million dollars exceeded by fivefold, NJSSI's total projected budget in years 6-10. NJSSI would have to get its costs under control before trying to use this recommendation to "scale-up".

(4) There is no evidence concerning the NJSSI's impact on science achievement in the state at any grade level. We don't know if NJSSI's impact on science was positive, neutral, or negative.

(5) The increase in students taking AP courses is one of the most positive components of educational change in New Jersey[9]. Impressively, there was no state policy to facilitate growth of AP enrollments, and NJSSI did almost nothing to increase student participation in any AP course. The increase in AP courses was due to collaborative efforts at the local level of the following actors: students requesting AP courses, parental support for the courses, a desire on the part of administrators to offer the courses, and finally, a desire on the part of the faculty to teach AP courses. This local collaboration has been most successful in the economically advantaged suburban areas. High schools in the most affluent communities in New Jersey often offer 10 different AP courses. This local collaboration has been least successful in urban areas, where schools often offer 4 or less AP courses. However, gains in AP enrollment span the entire socio-economic spectrum.

The drop of 12.3% in AP calculus enrollments for urban schools affiliated with NJSSI is surprising, since the state exhibited strong enrollment gains for this subject from 1995-1997, and urban schools with no NJSSI affiliation also showed gains in enrollment. It is **possible** that the negative AP enrollment trend lines observed in SSI affiliated urban schools could be due to policies advocated by the NSF and NJSSI. During the early years of the SSI program, NJSSI and NSF advocated school districts eliminate general math and science courses. Some school districts in New Jersey followed those recommendations. A couple of years later, these school districts determined that eliminating general math and science courses did not work, and reinstated these courses in the curriculum. However, it will take at least two years, and probably at least three years, to determine if reinstating general math and science courses positively impact course enrollments in Advanced Placement: Calculus, Biology, Physics, Chemistry and Computer Science.

(6) About 11% of the school districts engaged in SSI programmatic activity dropped out of NJSSI in 1997-1998. One of those districts dropping out, Paterson, left the Thrust II program. As mentioned earlier, 85% of Paterson's students are eligible for free and reduced lunch, making this district one of the neediest in the state. The other districts dropping out of NJSSI left the Thrust III program.

With 8 districts dropping of NJSSI, analysts using the NJDOE School Report Card in 1998 can set up stronger research designs than those used in this paper to estimate the initiative's programmatic impact. For example, analysts could set up a removed treatment design with pre-test and post-test, the strongest non-experimental design, (see Cook and Campbell 1979) to ascertain if Paterson's growth curves on state mandated assessments were any different than the growth curves of urban schools remaining in NJSSI's Thrust II initiative. With 35 schools, Paterson, the third largest school district in New Jersey, has sufficient numbers of schools and students to permit analysts to successfully estimate these relationships. Analysts could also set up a three group design to estimate the impact of Thrust III; districts completing the program, districts dropping out of the program, and districts not involved in the program. We note here that the first analysis concerning the student achievement impact of Thrust III will be available when the 1998 data is released. These stronger research designs, available only because school districts dropped out of NJSSI programs, will enable the NSF to get a clearer picture of the impact of the initiative's accomplishments.

(7) SSIs could be detrimental to a school's educational improvement plan. Some schools are involved an abundance of programs to improve educational achievement. Additional educational improvement programs (SSI or non-SSI) can create management overload, a situation where there is not enough time or staff to implement any one program well. Teachers, especially in self-contained classrooms, need to keep these programs in their minds, sometimes all at once. Central office staff need to administer these programs. The problems of information, management and program overload is especially true in large urban districts. Large urban districts are involved in many programs, perhaps more than they can comfortably handle. Reducing the load of programs may be beneficial, especially for a school district like Paterson. From this perspective, tracking growth on state mandated assessments for districts/schools dropping out of NJSSI will be especially illuminating.

(8) No voluntary educational reform effort can succeed without strong cooperation from the school districts. As mentioned before, the NJSSI's relationship with school districts was very week. Demand for NJSSI services was very low. Low demand for services does not bode well for the future of NJSSI.

(9) The SSI had no positive impact on equity. When the SSI was birthed in 1993, New Jersey had a substantial knowledge gap between performance of underserved and better served students. The statistical effect called "regression towards the mean" would predict that urban students would show some modest improvement, and affluent students from suburban schools would show some modest decreases in performance, even if NJSSI's equity programs were unsuccessful. Incredibly, we find the knowledge gaps increasing. The knowledge gap increased with respect to performance on the state mandated 8th grade mathematics assessment. The knowledge gap also increased in passing rates in Advanced Placement (AP) Calculus, AP Biology, and AP Computer Science. With respect to equity, New Jersey is in worse shape today (in 1998) than 1993.

<u>Conclusions Pertinent to the NSF SSI program</u>

(1) NSF changed over the years on the question of whether the SSIs should focus on depth vs. breadth of activity at the school level. In the early years, NSF wanted depth

of activity. The SSIs were encouraged to create models for change, determine if those change models worked, and then scale-up successful components of the reform initiative. In more recent years, desiring to report big numbers of schools reached to the U.S. Congress (and other audiences), NSF stressed breadth of activity. SSIs were encouraged to scale-up activity to a wide number of schools. As a result of NSF's change in strategy, SSIs may have spread themselves too thin. Our analysis suggests that reaching one or two teachers is not sufficient to impact student achievement in a school. We estimate that seven teachers are needed before a small positive impact on achievement exists. If the case of NJSSI can be generalized to other SSIs, many schools across the country have been superficially impacted by the SSI program due to the strategy of NSF stressing breadth over depth. Therefore, we recommend that the NSF revisit their managerial strategy, stressing breath over depth.

(2) It might be important to note that the NSF's classification of focal schools, (the training of 5 teachers [or 25% of the science or math teachers] in a school), was insufficient to positively impact a school's scores on state mandated assessments. If the focal schools indicator was an attempt to assess depth of an SSI's activity, we hope the NSF would consider investigating what kind of training, and with what numbers of teachers, would be required before a "critical mass" of "change agents" exist in a school. Clearly, the NSF would not want to set the minimum number of trained teachers required to classify a school as focal too high. Setting the number for focal schools too high would create low reach numbers for SSIs, and create political problems for NSF when dealing with other audiences, most notably the U. S. Congress. On the other hand, setting the reach numbers too low sets up a situation where the NSF is claiming that SSIs intensively reached a school, yet indicators on student achievement indicate that no positive accomplishment resulted from SSI activity.

(3) The SSIs are limited by NSF's focus on science and mathematics. Support of the school principals--often noted as a critical determinant of successful reform initiatives--was lacking. NJSSI hoped, and requested, that principals attend the summer training institutes. In visits to the training sites, only 3 principals were present, out of 213 participants. Principals will not spend a substantial amount of their time in programs exclusively limited in disciplinary focus. Principals take a broader disciplinary perspective, and invest their time in programs that are wide ranging.

(4) The NSF wanted a number of different actors to work together towards a common goal of improving SMT education. Curiously, the NSF did not practice what it preached when implementing the program. The NSF did not work with another major government agency with a strong interest, and a history of attempting to improving k-12 educational outcomes, the US Department of Education (USDOE). An affiliation between the USDOE and NSF could have given the SSI program a broader disciplinary focus, and legitimate educational improvement efforts in reading, writing, and English.

We note here the NSF and USDOE have very recently announced that they will work together "to implement an action strategy to support local efforts to put in place the rigorous courses and effective teaching that will build a strong foundation in middle years" (http://www.ed.gov/TIMSS/overview.html). In the future, we hope that these collaborative efforts will yield dividends. Additionally, we hope that analysts of the USDOE-NSF joint program will not have to go out of their way to look at "spillover" effects--effects outside the prime domain of NSF--in order to analyze improved student performance in reading and writing. With the help of the USDOE, we hope that future NSF funded educational reform initiatives will embed the strong

expectation that all disciplines: science, math, technology, reading, English, writing, and others, will all show improvements.

(5) Lack of accountability has been a major problem with the NSF SSI program. States like New Jersey claim to have reached 80%+ of the teachers and school children in the state, but the NSF has no mechanism to easily verify such claims. Our analysis showed that NJSSI reached, at best, about 20% of the school teachers in New Jersey. In a competitive situation, where the NSF will only renew a limited number of SSI's, an accountability mechanism to verify state claims is essential.

An even more important question than the reach of an SSI is whether the programmatic activity did any good. Did the SSI add value to a state's educational program? Our analysis shows that NJSSI's 8th grade math program did not impact the state positively. With data sets like the NJDOE school report card, the NSF could conduct comparative analysis on achievement gains, provide some accountability, and a greater sense of legitimacy in the student achievement area than simply accepting claims made by individual SSIs.

(6) The public does not view science as the "basics". In one statewide random sample, 88% of respondents responded that math would be classified as the basics. Science was classified as the "basics" with 43% of respondents (1995 Colorado Education Standards Survey). States assess the basics, and, occasionally, subjects outside the basics. Not every subject can be assessed. New Jersey only assess the basics; reading, writing and mathematics. Science is not yet assessed. Science competes with a number of non-basic disciplines for the honor to be assessed. The decision to assess science creates a burden and cost for a state. If the responses of the Colorado Education Standards Survey are typical, states do not face much public pressure to assess science. Science does not have the same stature with the public as mathematics. It will take the NSF, and the rest of the federal government, quite a number of years to heighten public awareness on the importance of assessing science.

(7) What are the limitations of SSIs? With a $3 million yearly budget, NJSSI tried to influence k-12 education in New Jersey, a $12-13 billion dollar a year business. Put another way, for every $4000 spent on k-12 public school education in New Jersey, NJSSI spends $1. What is realistic to expect for that $1? At one level, the NSF got a few paid lobbyists in a state, attempting to influence the political and bureaucratic machinery of government to alter SMT education in New Jersey towards NSF's view (active learning). Beyond the political dimension, could NJSSI realistically be expected to make an impact on equity or student achievement with a $3 million dollar budget? We found that NJSSI made virtually no positive impacts on either of these two critical issues. NJSSI clearly fell short on these dimensions, with limited reach, weak programs, and an insufficient diversity of people knowledgeable on issues pertaining to urban education.

Concluding Summary: The CPRE Questions

CPRE raised three evaluation questions pertinent to the SSIs.

1. Are students learning more because of these SSIs?

2. Are students better equipped to apply what they are leaning to everyday problems in the community and in the workplace?

3. Are the inequities in performance among different groups of students being reduced?

In summary, we find no evidence for question number 1. Students in schools affiliated with NJSSI did not learn more than their counterparts enrolled in schools with no NJSSI affiliation. There was no value added in the NJSSI schools. We have only very limited evidence with respect to evaluation question number 2. The evidence comes from the information on the transition to early adult life, where we found that students in SSI affiliated schools were slightly less likely to expect a successful transition to early adult life than students in schools not affiliated with NJSSI. We would feel more comfortable concluding that we don't know the answer to question 2. Question 3 was easily answered by the data. Inequities in performance got worse. The equity situation in New Jersey is worse today than in 1993.

Endnotes

1: Given the history of educational initiatives, the renewed SSIs should expect, and anticipate, another shift from the NSF about 4 years. Educational fads are in vogue for about five years. Renewed SSIs from Cohorts II and III may have to face that fact that the standards-based educational reform movement will not live up to expectations, and the NSF may embrace yet another fad around the year 2002.

2 The court ruled that two special needs districts, Hoboken and New Brunswick were adequately funded. These two districts did not receive any additional funds from the court ruling.

3. We note here that the management of NJSSI uses a different counting system. NJSSI will claim impact for an entire district (100% of teachers and 100% of students) with as few as one teacher going through a professional development experience. For example, in Toms River, one teacher went through a New Teacher Institute program. [We will not deal with the question of whether this non-SSI training should count in the SSI professional development.] Due to the activity of one teacher, NJSSI will claim to have impacted the entire district of Toms River, a district with 17,000+ students and 1,000+ teachers! NJSSI never postulated an innovation or diffusion model that would explain how one teacher could have had such an impressive impact on a school district. It was simply asserted that if one teacher goes through an experience, the entire district has been reached. It is through this counting procedure--reaching one teacher in a district means the SSI can claim 100% of the students and teachers--that the SSI claims to reach over 80% of the students and teachers in New Jersey.

When it comes to estimating commitment to standards-based curriculum, the NJSSI has an even bigger leap of faith. The NJSSI will claim that a district exhibits a strong commitment towards standards-based curriculum and instruction with as few as one teacher going through Thrust I. NJSSI will make that claim despite the fact that the professional development training (called Thrust I) had no standards-based instruction in the first three years, and required no district commitment of curriculum change. Over 98% of the intensive professional development at NJSSI occurred when the initiative was striving for systemic reform. Only 2% of the intensive professional development at NJSSI occurred when the initiative was considered standards-based. Overall, these issues bring up a fundamental problem in NSF's SSI program, the lack of accountability. Particular SSI's can make claims, but the NSF has no way to verify the claims. We will deal with the accountability issue in the concluding section of the paper.

4. Special needs districts were defined by the NJDOE through a principal components factor analysis of the following seven variables: percent of adult residents who failed to complete high school, percent of adult residents who attended college, occupational status of adult household members, population density, income, unemployment and poverty. A single measure of socio-economic status was then created from the factor analysis. Special needs districts come from the bottom of that socio-economic scale.

5. NJDOE did include science in the pilot of the 4th grade assessment. Scores from this assessment were not released to the districts, nor to NJSSI.

6. One can easily criticize these research exercises in a number of important ways Subjects were not randomly selected, the control group was self-selected, so strictly speaking, statistical inference would be inappropriate. Additionally, there was no control in the way teachers implemented these research exercises. Thirdly, since the exercise was completed in one class period (typically 40-50 minutes), the domain of questions was limited. In some cases, only one question was asked. Fourth, all questions required a written answer, so there was no variation in the modality of responses. Lastly, the questions would not permit the SSI to claim that students were learning more. Based on the Horizon questions, NJSSI *might* have been able to claim that students in classes taught by NJSSI trained teachers were able to perform better on questions requiring a specific set of skills (e.g., performance based), than students in classes taught by teachers without NJSSI training. However, the Horizon exercises could not determine if gains in performance-based skills were offset by decreased skills in answering questions from any other type of assessment modalities (e.g., multiple choice, constructed open-response, essays, portfolios, and giving a speech). We would need to know if gains made on one modality of assessment were not offset by losses on other modalities of assessment before we could conclude that students learned more. The Horizon questions could only assess whether student achievement was different in classes taught by NJSSI trained teachers. Lacking the critical check of other assessment modalities, Horizon could not determine if gains made with performance-based work came at the expense of other type of knowledge. For these reasons, the Horizon questions were too limited to address the CPRE evaluation question concerning whether students learned more due to the SSIs.

7. Some institutions of higher education voluntary dropped out of Thrust I, others were determined to perform at less than a satisfactory level and were phased out.

8. Some districts did pay teachers a stipend for participating.

9. Gains in Advanced Placement course enrollments are not limited to New Jersey. These gains have been experienced by many states, and represent a national phenomenon.